Population Genetics

Natural Selection

Natural selection is the process by which heritable traits that make it more likely for an organism to survive and successfully reproduce become more common in a population over successive generations. It is a key mechanism of evolution.

The natural genetic variation within a population of organisms means that some individuals will survive and reproduce more successfully than others in their current environment. For example, the peppered moth exists in both light and dark colors in the United Kingdom, but during the industrial revolution many of the trees on which the moths rested became blackened by soot, giving the dark-colored moths an advantage in hiding from predators. This gave dark-colored moths a better chance of surviving to produce dark-colored offspring, and in just a few generations the majority of the moths were dark. Factors which affect reproductive success are also important, an issue which Charles Darwin developed in his ideas on sexual selection.

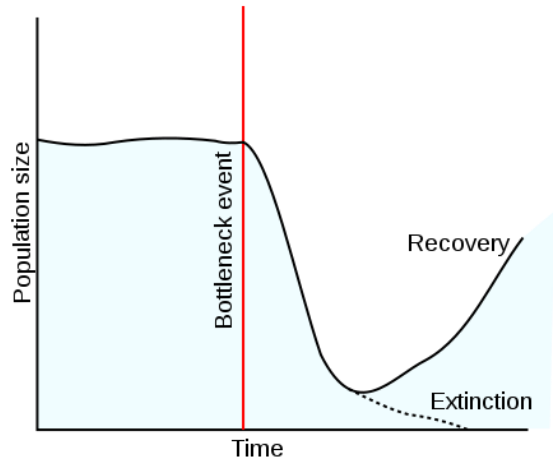
Natural selection acts on the phenotype, or the observable characteristics of an organism, but the genetic (heritable) basis of any phenotype which gives a reproductive advantage will increase in frequency over the following generations (see allele frequency). Over time, this process can result in adaptations that specialize organisms for particular ecological niches and may eventually result in the emergence of new species. In other words, natural selection is an important process (though not the only process) by which evolution takes place within a population of organisms.

Bottle Neck

A **population bottleneck** (or genetic bottleneck) is an evolutionary event in which a significant percentage of a population or species is killed or otherwise prevented from reproducing.[1]

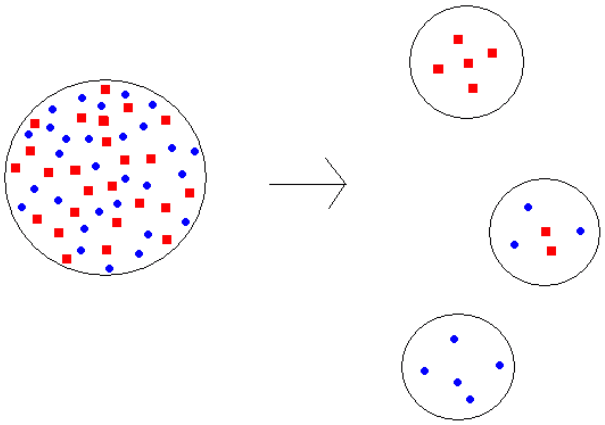
Population bottlenecks increase genetic drift, as the rate of drift is inversely proportional to the population size. They also increase inbreeding due to the reduced pool of possible mates (see small population size).

A slightly different sort of genetic bottleneck can occur if a small group becomes reproductively separated from the main population. This is called a founder effect.



Founder Effect

In population genetics, the founder effect is the loss of genetic variation that occurs when a new population is established by a very small number of individuals from a larger population. As a result of the loss of genetic variation, the new population may be distinctively different, both genetically and phenotypically, from the parent population from which it is derived. In extreme cases, the founder effect is thought to lead to the speciation and subsequent evolution of new species.
In the figure shown, the original population has nearly equal numbers of blue and red individuals. The three smaller founder populations show that one or the other color may predominate (founder effect), due to random sampling of the original population. A population bottleneck may also cause a founder effect even though it is not strictly a new population.



Genetic drift or allelic drift

Genetic drift or allelic drift is the change in the relative frequency with which a gene variant (allele) occurs in a population due to random sampling and chance: the alleles in offspring are a random sample of those in the parents, and chance has a role in determining whether a given individual survives and reproduces. A population's allele frequency is the fraction of the gene copies that share a particular form.
Genetic drift is one of several evolutionary processes which lead to changes in allele frequencies over time. It may cause gene variants to disappear completely, and thereby reduce genetic variability.
In contrast to natural selection, which makes gene variants more common or less common depending on their reproductive success, the changes due to genetic drift are not driven by environmental or adaptive pressures, and may be beneficial, neutral, or detrimental to reproductive success.
The effect of genetic drift is larger in small populations, and smaller in large populations. Vigorous debates wage among scientists over the relative importance of genetic drift compared with natural selection.